THE CALIFORNIA DEPARTMENT OF HEALTH SERVICES
CALIFORNIA BIRTH DEFECTS MONITORING PROGRAM

MONITORING FOR BIRTH DEFECTS FOLLOWING THE CANTARA LOOP SPILL

December 1992

■ SUMMARY

On July 14, 1991, 19,000 gallons of the herbicide metam-sodium spilled into the Sacramento River when a train derailed near the town of Dunsmuir, California. Following the spill, people in the area complained of eye irritation, nausea and other symptoms. In addition, the local community was concerned about the effect of exposure to the spill on the outcome of pregnancies. In response to these concerns, the California Birth Defects Monitoring Program (CBDMP) carried out an investigation to determine whether any excesses in birth defects occurred among children born to women potentially exposed to the spill during their pregnancy.

The exposure area was defined as communities between Mt. Shasta and Lakehead. Birth defects occurring among infants and fetuses potentially exposed in utero were identified by

- routine surveillance of all deliveries in Shasta and Siskiyou Counties between July 14, 1991 and April 30, 1992,
- review of prenatal alpha-fetoprotein screening results among residents of the exposure area for the four month period following the spill, and
- review of reports involving adverse pregnancy outcomes phoned in to the CBDMP and the Environmental Health Investigations Branch (EHIB).

Out of a population at risk of 100 deliveries, one infant was identified with a structural birth defect. The defect affected the gastrointestinal system. The background rate of birth defects throughout California is approximately 3%. Therefore, the occurrence of one child born with a birth defect is not higher than expected. It is impossible to say whether metam-sodium was the putative agent for the one birth defect case identified. There have been no reports linking exposure to metam-sodium with birth defects, other than neural tube defects in rats and rabbits.

This investigation was limited to structural malformations. In order to fully assess the reproductive toxicity of metam-sodium, other reproductive endpoints, including spontaneous abortion, premature birth, and stillbirth, will be examined by EHIB. The CBDMP will continue to monitor the babies born in the 9-month period following the spill in Shasta and Siskiyou Counties for birth defects which become apparent after the first months of life.

■ BACKGROUND

As a result of the Southern Pacific train derailment on July 14, 1991, 19,000 gallons of the herbicide metam-sodium were released into the Sacramento River approximately six miles north of the town of Dunsmuir in Northern California. The chemical plume travelled 45 miles downstream to Lake Shasta, releasing toxic fumes into the air. Air and water monitoring shortly after the spill revealed detectable levels of MITC and hydrogen sulfide, two breakdown products of metam-sodium, all along the 45-mile stretch of river between the spill site and Lakehead at the northern rim of Lake Shasta. After July 25, no detectable levels of metam-sodium or its breakdown products were found in water or soil samples taken at the spill site and in the surrounding area. Wind conditions on the night of the spill may have resulted in upstream exposure. Following the

spill, people in the area complained of eye irritation, nausea, skin rashes and other symptoms. In addition, the local community was very concerned about the potential for birth defects and other adverse pregnancy outcomes resulting from exposure to metam-sodium.

Although metabolic studies have not been conducted in humans, it is believed that metam-sodium is cleared from the body within 24 hours of exposure based on results from animal studies (personal communication with Lubow Jowa, Office of Environmental Health Hazard Assessment).

The effect of metam-sodium on human reproduction has not been previously studied. However, in developmental toxicity studies conducted in rats and rabbits, exposure to high doses of metam-sodium resulted in fetal death and neural tube closure defects.

In response to concerns regarding the effect of exposure to metam-sodium on the outcome of pregnancy, the CBDMP carried out an investigation to determine whether any excesses in birth defects occurred among children born to women potentially exposed to the spill during their pregnancy.

■ METHODS

Based on the environmental monitoring data and symptom reports, all residents of communities from Mt. Shasta in the north to Lakehead in the south were considered potentially exposed. This included residents of the following zipcodes: 96067, 96025, 96017, and 96051.

To identify birth defects occurring among infants and fetuses in the exposed area, three approaches were utilized. First, the CBDMP visited all hospitals and birthing centers in Shasta and Siskiyou Counties, and facilities outside Shasta and Siskiyou Counties where women residing in the exposure area deliver or sick infants are referred (Rogue Valley Hospital in Oregon, and University of California at Davis). Logs were reviewed to identify liveborn and stillborn infants diagnosed with birth defects who were born during the nine month period following the spill (July 14, 1991 to April 30, 1992), and whose zipcode at delivery was one of the four zipcodes considered exposed. Cases of structural birth defects were abstracted according to routine CBDMP procedures[1]. Over 200 conditions are routinely monitored, including defects of the heart, limbs, neural tube, cleft lip, and cleft palate. Chromosomal anomalies, such as Down syndrome, are monitored as well. The CBDMP does not collect information on conditions that are not structural birth defects such as mental retardation, learning disabilities, cancer, AIDS, and cystic fibrosis.

Second, Genetic Diseases Branch (GDB) carried out additional casefinding for neural tube defects by reviewing all prenatal maternal serum alpha-fetoprotein (MSAFP) screening results during the four-month period following the spill for women residing in the exposure area at the time of their test.

Third, the Department of Health Services received several reports of adverse pregnancy outcomes for women who delivered outside Shasta and Siskiyou Counties, but who were potentially exposed during their pregnancy. Even though such reporting was incomplete, all such reports were reviewed by CBDMP epidemiologists.

■ RESULTS

Among pregnancies with hospital of delivery in Shasta and Siskiyou Counties, no cases of birth defects were identified that had a residence address at delivery in the four-zipcode area. No cases of birth defects were revealed by prenatal MSAFP screening (personal communication from Linda Lustig, GDB). However, one infant diagnosed with a structural birth defect was identified through a report to EHIB. Although the infant was delivered outside of Shasta and Siskiyou Counties, the mother was in the exposure area and potentially exposed for approximately 48 hours sometime during 10-12 weeks gestation. The congenital anomaly affected the child's gastrointestinal system.

The rate of birth defects among all infants throughout California is 3.2%. This rate is based on diagnoses made throughout the first year of life.

Because some conditions are not apparent until several months of age, the rate of birth defects diagnosed in the newborn period (the first 28 days) is 2.7%. The infants in this study were followed for varying amounts of time depending on their date of birth. For example, an infant born in November '91 was followed for 6 months, whereas an infant born in April '92 was followed for less than 1 month. Therefore, the expected rate of birth defects in this population is 2.7-3.2%.

To determine whether the finding of one child born with a birth defect was higher than expected, the population at risk was calculated by estimating the number of births occurring in the exposure area in the nine month period following the spill. As the live birth and fetal death records are not yet electronically available for this period, the 1990 vital statistics records were used to estimate the number of births between July 14, 1991 and April 30, 1992. For the 12 month period beginning January 1, 1990 and ending December 31, 1990, 126 infants were born to residents of the four exposed zipcodes (96067, 96025, 96017, 96051). Assuming no increase in the birth rate between 1990 and the time period of interest, we would expect approximately 100 births to occur during the nine month period following the spill. Given that the background rate of birth defects is approximately 3%, we would expect to observe 2-3 children with birth defects born to a population of 100 births, irrespective of some teratogenic exposure. Therefore, the occurrence of one baby born with a malformation in this population is not higher than expected.

■ DISCUSSION

For the one child born with a birth defect whose mother was potentially exposed, it is impossible to say whether metam-sodium was the putative agent. There have been no reports linking exposure to metam-sodium or its breakdown products with any birth defect other than neural tube defects in rats and rabbits. The kind of gastrointestinal system defect which was reported is believed to be related to an intrauterine vascular accident occurring at some point after the complete formation of the bowel which occurs at 6 weeks gestation[2].

Limiting the population at risk to residents of the exposure area gives the smallest number of births at risk, resulting in the highest observed rate and the highest estimate of risk. If all potentially exposed women, including those residing outside of the exposure area, were included in the population at risk, the observed rate of birth defects following this incident would be even smaller than 1%.

The pregnancy outcomes that were followed in this investigation were limited to structural malformations in live births and fetal deaths. We did not monitor for pregnancies ending in prematurity, early spontaneous abortion, therapeutic abortion, or fetal deaths or stillborns without structural birth defects. In order to fully assess the reproductive toxicity of metam-sodium, all reproductive endpoints need to be examined. To this end, EHIB conducted a door-to-door survey of Dunsmuir residents which included several questions regarding the outcome of pregnancies following the spill. This survey will be able to identify whether rates of spontaneous abortion, premature birth or stillbirth need further follow-up. The findings of this survey will be reported at a later date by EHIB.

Only women who delivered in facilities in Shasta and Siskiyou Counties and in referral hospitals for the area were systematically followed. Women who were in the exposure area during their first trimester of pregnancy, but delivered outside of the area were not routinely ascertained. However, some reports were made to the CBDMP of adverse pregnancy outcomes among women in the exposure area at the time of the spill who delivered outside the study area. The one birth defect described above was such a report.

The population at risk was defined using the residence at delivery, not residence during the first trimester. There may have been women who were in the area during their first trimester of pregnancy who actually resided outside the area and delivered outside the area. Examples of these people include vacationers camping along the river, fishing in the river, or in houseboats on Lake Shasta. Also, women who drove through the area, or who worked in the area but lived outside it were not included in this investigation if they delivered outside of Shasta

and Siskiyou Counties. We did not systematically include these pregnancies in our study because it was impossible to rigorously identify these people.

■ RECOMMENDATIONS

Because structural malformations may not be apparent in the newborn period, the CBDMP follows all liveborn infants until their first birthday. We recommend that we continue to monitor all babies born in the study period for birth defects which may be diagnosed in their first year of life. A follow-up report will be issued by the end of December, 1993. In addition, the CBDMP, as part of its registry activities, will continue to do routine surveillance for birth defects in Shasta and Siskiyou Counties.

■ REFERENCES

1. California Birth Defects Monitoring Program. Procedure manual for data collection. October, 1989.

2. deSa DJ. The alimentary tract. In: Wigglesworth JS, Singer DB, eds. Textbook of fetal and perinatal pathology, Volume 2. Boston, MA: Blackwell Scientific Publications, 1991:923-52.

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CALIFORNIA BIRTH DEFECTS MONITORING PROGRAM

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